UTAH GEOLOGICAL SURVEY
a division of the
UTAH DEPARTMENT OF NATURAL RESOURCES
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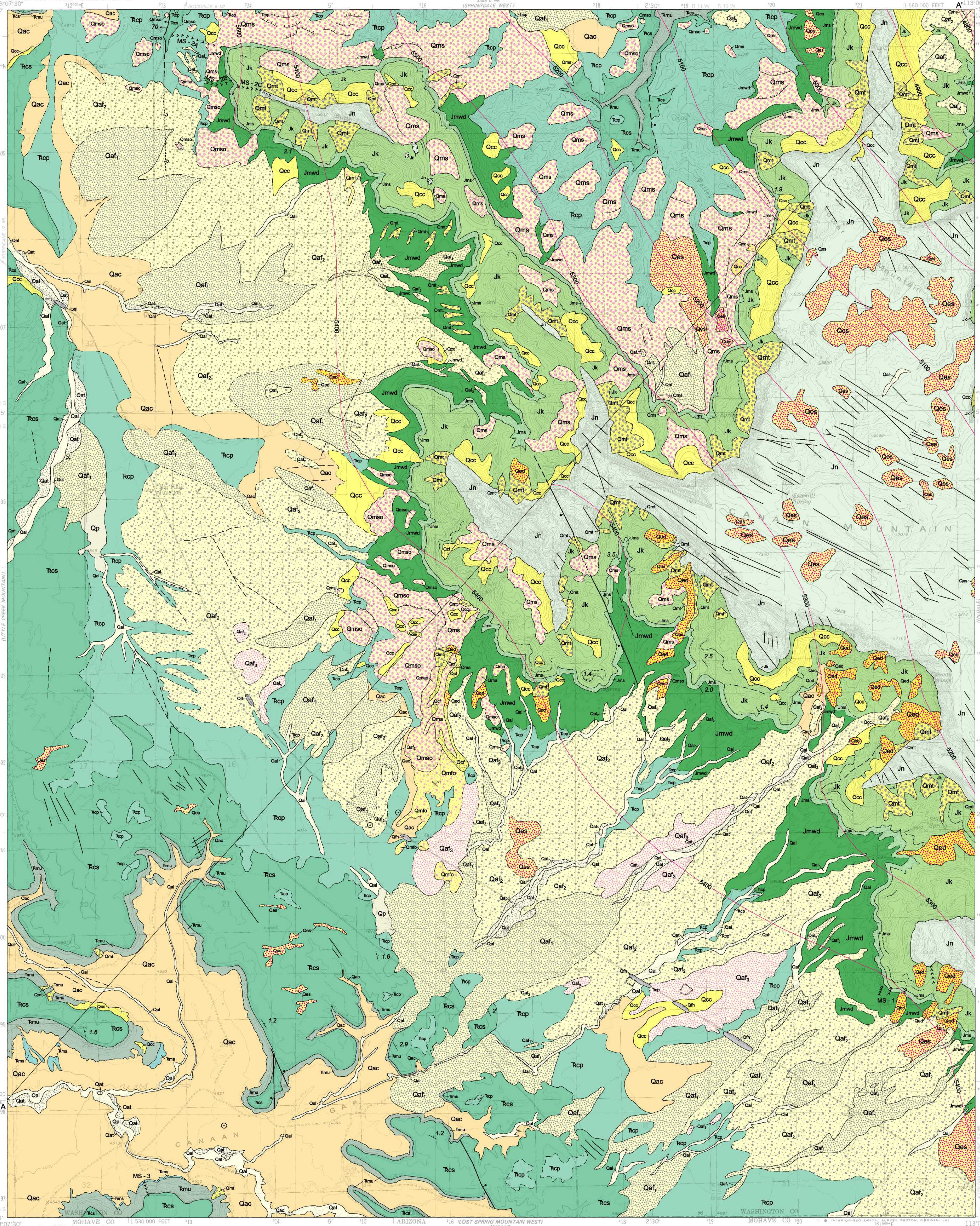
UNITED STATES GEOLOGICAL SURVEY

Plate 1
Utah Geological Survey Miscellaneous Publication 01-1
Geologic Map of the Smithsonian Butte Quadrangle



Base map from U. S. Geological Survey
Smithsonian Butte 7.5' Quadrangle, 1980

SCALE 1 : 24,000

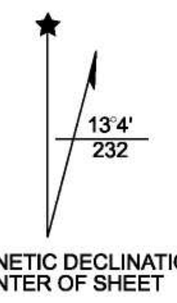
1 — 1/2 — 0 — 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Geology mapped in 1986 and 1989 by Sable
and in 1990 by Moore assisted by
Charles Tabor and Brenda Buck
Photogrammetric assistance by James Messerich
Digitized by Art Straub



2001 MAGNETIC DECLINATION
AT CENTER OF SHEET

GEOLOGIC MAP OF THE SMITHSONIAN BUTTE QUADRANGLE, WASHINGTON COUNTY, UTAH

QUADRANGLE LOCATION

by

David W. Moore
and
Edward G. Sable

2001

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Plate 2
Utah Geological Survey Miscellaneous Publication 01-1
Geologic Map of the Smithsonian Butte Quadrangle

DESCRIPTION OF MAP UNITS

Qfh — Highway fill (Holocene)—*Rock and soil emplaced by earth-moving equipment*

Qal — Channel alluvium (Holocene)—*Reddish-brown and reddish-yellow silty, very fine to coarse quartz sand containing granules, pebbles, cobbles, and scarce boulders of sandstone; alluvium in Little Creek is pale brown with quartzite gravel; grains within individual strata moderately well sorted; highly variable grain size among strata; underlies floodplains and adjacent low terraces; unit grades into Qac and Qaf_1 deposits; estimated thickness 4 to 12 feet (1.2-4 m)*

Qac — Alluvium and colluvium (Holocene)—*Reddish-brown, silty and clayey fine to very fine quartz sand, locally coarse sand, scarce sandstone and quartzite pebbles, mostly alluvium on gently sloping land; colluvium derived from nearby hillslopes; interfingers with Qal; one to 3 feet (0.3-1 m) thick at distal edge of alluvial fans;10 to 35 feet (3-11 m) thick in Canaan Gap area; water wells west of quadrangle indicate thickness may exceed 50 feet (15 m)*

Qcc — Coarse colluvium (Holocene)—*Red, yellowish-red, and pale-red sandy gravel to gravelly sand slope deposit; abundant angular sandstone gravel fragments; includes minor talus and alluvium; 2 to 40 feet (0.7-12 m) thick*

Qcf — Fine colluvium (Holocene)—*Moderate-brown fine quartz sand, silt, and minor sandstone pebble-size pieces; silt reworked by wind locally; about 2 feet (< 1 m) thick*

Qp — Playa deposit (Holocene)—*Light-brown silty clay including very thin beds of sandstone pebbles, cobbles, and scarce small boulders washed in by sporadic flash floods; thinly laminated, friable; interfingers laterally with sandy distal fan alluvium (Qaf_1); estimated thickness 2 to 8 feet (0.7-2 m)*

Qes — Eolian sand, sheet-wash, and residuum, undivided (Holocene)—*Sand, fine- to medium-grained quartz; light brown, orange, pink, and yellowish gray; veneer of mostly stabilized sheet sand and small dunes on alluvial fans; on mesas and buttes is irregular fillings in bedrock hollows and deposits of intermittent streams; locally includes small outcrops of bedrock; generally 1 to 4 feet (0.3-1 m) thick; 2 to 6 feet (0.7-2 m) thick at head of Horse Valley Wash*

Qed — Eolian-sand dunes and ramps (Holocene)—*Wind-blown sand, like unit Qes except no appreciable alluvium or residuum; sand accumulates in ramp-like mantles and small dunes on talus; may grade downslope into unit Qes; 2 to 6 feet (0.7-2 m) thick*

Qmt — Talus (Holocene)—*Blocky debris, brown, pink, and reddish-brown sandstone; steep (25° to 30°) aprons and cone-like deposits at foot of cliffs; (talus in adjoining Hildale quadrangle of Sable,1995, p. 8, is included in unit Qc); talus is 2 to 20 feet (0.7-6 m) thick*

Qaf_1 — Young fan alluvium (Holocene to upper Pleistocene)—*Reddish-brown to reddish-yellow silt, sand, and sandstone gravel on broad, sloping surfaces, parts of which presently are aggrading; crudely bedded; bedding dips 1° to 4° mainly southwest; mid- and down-fan segments are chiefly pebbly sand; weak to no soil development in uppermost part; fan surfaces are not deeply eroded and are at a geomorphic level of a few feet to as much as 30 feet (10 m) above modern streams; 2 to 20 feet (7-6 m) thick*

Qat — Terrace alluvium (Holocene to upper Pleistocene)—*Silt, sand, and gravel similar to Qal; occurs as nearly flat, tabular deposits of former channels and floodplains 6 to 15 feet (2-4.5 m) above modern stream channels; 2 to 6 feet (0.7-2 m) thick*

Qms — Landslide debris (Holocene to upper Pleistocene)—*Heterogeneous debris; matrix is clay- to sand-size; clasts of sandstone range from granules to blocks as long as 500 feet (150 m); strata in blocks are brecciated or coherent; some colluvium (Qcc) included; some Toreva blocks are active; estimated thickness 10 to 150 feet (3-46 m)*

Qaf_2 — Intermediate-age fan alluvium (upper Pleistocene)—*Silt, sand, and gravel; reddish-orange and reddish-brown very fine to fine quartz sand, subordinate medium to coarse quartz sand; lenses of clay; in upper part of fan, sandy subangular to subrounded sandstone pebbles, cobbles, and boulders and interbeds of clayey gravel (mudflow deposits); crudely stratified; unit is higher and more eroded than Qaf_1, and in upper 3 feet (1 m) is an A/C horizon soil profile, and locally, reddish-brown Bt horizon 6 to 10 inches (15-25 cm) thick, moderately well developed; surface of deposit 30 to 60 feet (9-18 m) higher than modern stream level; thickness <2 feet (<1 m) at edges to 50 feet (15 m) at fan apex*

Qmf — Debris-flow deposit (upper Pleistocene)—*Unsorted, nonbedded clay, silt, sand, and blocky sandstone rubble derived from Mesozoic bedrock; matrix supported; common as interbeds (not mapped as such) near apex of alluvial fans; a distinctive mapped deposit occurs in section 27, T. 42 S., R. 11 W.; 4 to 20 feet (1-6 m) thick*

Qma — Rock-avalanche deposit (upper Pleistocene)—*Coarse angular sandstone fragments; forms a south-sloping, low, linear, rounded ridge that rests on an intermediate-age alluvial fan in NW¼ section 14, T. 43 S., R. 11 W. and two deposits in section 11; partly disintegrated to sand; 5 to 20 feet (1.5-6 m) thick*

Qaf_3 — Old fan alluvium (upper middle Pleistocene)—*Deeply weathered and degraded remnants of moderate-reddish-brown sand and sandy gravel, subangular to rounded sandstone pebbles, cobbles, and small boulders; sparse boulders as large as 5 feet (1.6 m) across; gravel-filled channels cut thick beds of yellowish-red, well-sorted, cross-laminated quartz sand, fine to medium grained; deposits form low hills 40 to 90 feet (12-27 m) higher than level of modern streams; surface soil at or near maximum development; unit is 10 to 25 feet (3-8 m) thick*

Qmfo — Old debris-flow deposit (upper middle Pleistocene)—*Weathered lobate deposit; chaotic; contains reddish-brown sandstone blocks of Kayenta Formation and variegated mudstone debris of the Petrified Forest Member; thins downslope; estimated maximum thickness 25 feet (7.5 m); 1 to 2 feet (<1 m) thick at edges*

Qmao — Old rock-avalanche deposit (upper middle Pleistocene)—*Weathered sandstone rubble, about 90 percent Navajo Sandstone, 10 percent Kayenta Formation; clasts are 1 inch (2.5 cm) across to car size; chiefly bouldery, chaotic, blocky rubble; upper 2 to 3 feet (0.6-1 m) cemented by secondary calcium carbonate and silica; lobate deposit with hummocky and south-sloping surface; 60 feet (18m) exposed in gully; base covered; estimated thickness 6 to 80 feet (2-24 m) or more*

Qmso — Old megaslide complex (upper middle Pleistocene)—*Complex of debris emplaced by landslides and Toreva rotational slumps, subordinate debris flows and rock falls; poorly consolidated mudstone and sandstone breccia derived from Petrified Forest Member and younger bedrock units; grain size is clay to huge blocks; hummocky, steeply to moderately sloping; estimated thickness 25 to 300 feet (8-91 m)*

Jn — Navajo Sandstone (Lower Jurassic)—*Light-brown, very fine- to fine-grained, with minor medium-grained quartzose sandstone, weathers grayish orange pink; some frosted subangular to subrounded equant grains; firmly to weakly cemented by iron-oxide-stained calcium carbonate and silica; massive, with sweeping high-angle cross-beds in sets 10 to 30 feet (3-9 m) thick; imposing cliffs, rounded hills, ledges, sloping rock faces and knolls; incomplete exposed thickness about 1,350 feet (about 410 m)*

Jk — Kayenta Formation (Lower Jurassic)—*Mudstone, siltstone, and sandstone; moderate reddish orange and pale red; very fine to fine-grained pinkish-gray sandstone is silty sublitharenite to subarkose, calcitic in places; sandstone beds are continuous to lenticular and exhibit small-scale trough cross-beds with medium-scale sets 3 to 6 feet (1-2 m) thick; also large-scale cross-beds; variegated mudstone forms earthy slopes; sparse, very thin micritic limestone beds near middle of unit; measured thickness 615 to 680 feet (190-207 m)*

Moenave Formation (Lower Jurassic)—*Consists of three members (descending): Springdale Sandstone, Whitmore Point Member and Dinosaur Canyon Member, the last two mapped as one unit*

Jms — Springdale Sandstone Member --*Pale-red, very light-gray, light-brown, very fine to fine-grained sublitharenite to feldspathic litharenite; weathers light to reddish brown, grayish orange and grayish orange pink; locally also white to very light gray; makes persistent cliff about 110 feet (33 m) high; forms flaggy to blocky rubble; intraformational sandy mudstone and dolomite pebble conglomerate to pebbly, medium-grained sandstone; contains sparse silicified fossil logs; load casts in purple mudstone near base; thickness 128 to 176 feet (39-54 m)*

Jmwd — Whitmore Point and Dinosaur Canyon Members--*Whitmore Point Member is variously light-colored, interbedded sandstone, siltstone, minor mudstone, and sparse thin limestone; viewed from afar, unit is a light-grayish and pinkish-gray slope; sparse Holostean fish scales, very dusky red; the member is 44 to 68 feet (13-21 m) thick. The "brick-red" (pale red and various reddish colors) Dinosaur Canyon Member is siltstone, mudstone, and silty, very fine-grained calcitic subarkose sandstone; trough cross-laminae; sparse thin interbed of micaceous soft shale; Dinosaur Canyon Member is 226 feet (69 m) thick*

Chinle Formation (Upper Triassic)—*Consists of two members, the Petrified Forest Member and the underlying Shinarump Member*

Trcp — Petrified Forest Member--*Variegated claystone and few beds of very fine-grained gray sandstone; contains volcanic ash beds altered to bentonitic clay and multicolored chalcedony pieces 0.5 to 2 inches (1.2-5 cm) across; few thick, lenticular, cross-bedded channel-fill sandstone beds; chiefly floodplain deposits; common paleosols; forms badlands; landslide prone; 286 feet (87 m) exposed, but upper part covered; total thickness probably 390 feet (119 m)*

Trcs — Shinarump Member--*Gray and grayish-orange, fine- to very coarse-grained sandstone, and granule to cobble conglomerate and conglomeratic sandstone; weathers pale grayish orange; well cemented; contains well-rounded clasts of sandstone, quartzite, chert and petrified wood pieces and logs; forms cliffs and cuestas; 111 to 119 feet (34-36 m) thick*

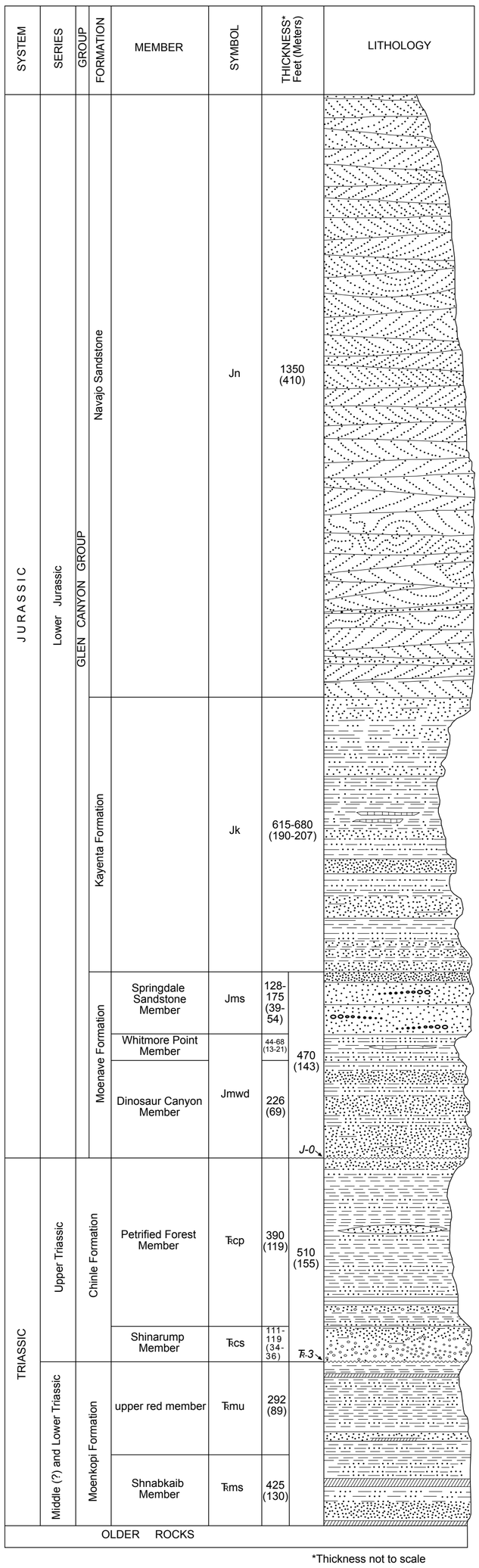
Moenkopi Formation (Middle? and Lower Triassic)--*Two members exposed in quadrangle, the entire upper red member and the upper part of Shnabkaib Member*

Trmu — Upper red member (Middle? and Lower Triassic)--*Light-brown, dusky-red, pale-red, grayish-orange-pink and moderate-brown alternating gypsiferous siltstone, very fine-grained quartzose sandstone, clayey siltstone, and dark-reddish-brown ("chocolate"-colored) silty mudstone; thin-bedded to laminated; thin veins and veinlets of small selenite crystals common; 292 feet (89 m) thick*

Trms — Shnabkaib Member (Lower Triassic)--*Grayish-orange-pink, gypsiferous siltstone alternating with light-brown and yellowish-gray crumbly mudstone which weathers to earthy slopes; exposed strata are about 20-60 feet (6-18 m) thick; the entire member is probably about 425 feet (130 m) thick in subsurface*

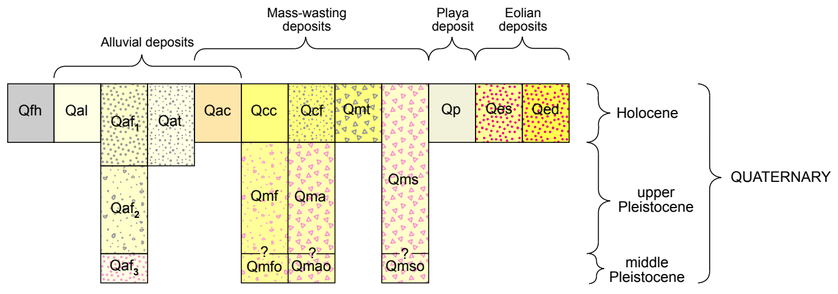
MAP SYMBOLS

- CONTACT--*dashed where approximate or inferred*
- FAULT--*bar and ball on downthrown block; dotted where concealed, dashed where approximate or inferred, queried where uncertain. Arrow and number show dip of fault plane in degrees* (70)
- LARGE TOREVA BLOCK OF NAVAJO SANDSTONE
- SCARP --*head of landslide or slump; hachures point in direction of movement*
- JOINT
- LINEAR FEATURE OBSERVED ON AERIAL PHOTOGRAPHS--*may be fault or joint trace*
- TOPS OF PROMINENT SANDSTONE BEDS--*in Kayenta Formation*
- 5500 — STRUCTURE CONTOUR--*datum, top of Springdale Sandstone Member of Moenave Formation; extrapolated where land surface is below datum; contour interval 100 feet*
- 2.5 — STRIKE AND DIP OF BEDS--*number is dip in degrees; calculated by computer-assisted photogrammetric methods on stereographic plotter*
- BORROW PIT
- PROSPECT PIT
- SAND AND GRAVEL PIT
- DRILL--PIPE CASING
- MS-2A — MEASURED SECTION



*Thickness not to scale

CORRELATION OF MAP UNITS



*unconformity of Pipiringos and O'Sullivan (1978)